Geostationary Operational Environmental Satellite (GOES)

GOES-R Series

Space Environment In-Situ Suite (SEISS)

Unique Instrument Interface Document (UIID)

Baseline Version 1.0

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National Aeronautics and Space Administration

Goddard Space Flight Center
Greenbelt, Maryland

To verify the correct version of this document, please contact the GOES R Series Requirements Management Office on 301-286-7898

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1 Scope

The purpose of this Unique Instrument Interface Document (UIID) is two-fold. The first is to allocate GOES-R series spacecraft resources to the Space Environment In-Situ Suite (SEISS). The second is to serve as a core building block on which the SEISS-spacecraft interface can be designed. The spacecraft integrating contractor and the SEISS contractor **shall** meet each of their respective interface requirements as defined in this document.

The Government **will** be the system integrator until a system performance contractor or spacecraft contractor with that responsibility is selected. Until that time, the Government **will** be responsible for accommodation trades, resource allocation (weight, power, space, bandwidth, etc.), and resolving interface issues. This UIID **will** govern the development of an Interface Control Document (ICD). The ICD development **will** be a joint activity of the SEISS and spacecraft contractors.

The SEISS ICD establishes the details of the electrical, communications, mechanical, thermal, integration and test, and command and data handling (C&DH) interfaces between the SEISS instrument and the GOES-R spacecraft. After the ICD is signed and approved by all parties, the spacecraft contractor **shall** maintain the ICD.

The SEISS particle sensors **shall** monitor the proton, electron, and heavy ion fluxes at geosynchronous orbit. The particle sensors include a magnetospheric particle sensor (MPS), an energetic heavy ion sensor (EHIS), and a solar and galactic proton sensor (SGPS).

This SEISS requires primary power and command input data from the spacecraft. Instrument output data to the spacecraft contains instrument information, instrument telemetry and ancillary data.

1.1 Document Overview

Together, the General Interface Requirements Document (GIRD) and the SEISS UIID establish the SEISS spacecraft interface requirements. The GIRD applies to all GOES-R instruments while the SEISS UIID is specific to the SEISS. Section 1 explains the use of this document. Section 3 allocates spacecraft resources, such as mass, power, and data rate, to the SEISS instrument Suite. Section 4 contains government-accepted operation constraints. Section 5 contains government-accepted deviations from the GIRD. Section 6 contains a list of acronyms used within this document.

1.2 Mission Requirements

The term "(TBD)", which means "to be determined", applied to a missing requirement means that the instrument contractor determines the missing requirement in coordination with the spacecraft contractor.

The term "(TBR)", which means "to be refined/reviewed", means that the requirement is subject to review for appropriateness by both instrument and spacecraft contractors, and subject to revision. Both the spacecraft and instrument contractors are liable for compliance with the requirement as if the "TBR" notation did not exist. The "TBR"

merely provides an indication that the value is more likely to change in a future modification than requirements not accompanied by a "TBR".

1.3 Order of Precedence

The order of precedence of interface requirements documents is the UIID at the highest level, followed in order by the GIRD, ICD, and IDD.

2 Reserved

3 Allocations

The GOES-R spacecraft **shall** provide data downlink, telemetry and power for the SEISS instruments throughout the entire mission including yaw flips and eclipse periods and on-orbit storage. The following paragraphs allocate these resources to SEISS.

3.1 Command and Data Handling

3.1.1 Instrument-to-Spacecraft Science Volume

The instrument science and engineering data rate, including all overhead associated with Consultative Committee for Space Data Systems (CCSDS) packetization by the instrument at the spacecraft interface, **shall** not exceed 4 thousand (10^3) bits per second when averaged over any 5 second period.

3.1.2 Telemetry Data Rate

Housekeeping telemetry data rate, including all overhead associated with Consultative Committee for Space Data Systems (CCSDS) packetization by the instrument at the spacecraft interface, **shall** not exceed 256 bits per second, when averaged over any 5 second period.

3.1.3 Application Process Identifiers

The SEISS **shall** use no more than 63 consecutive APIDs for science, telemetry, and command packets.

3.1.4 Spacecraft Telemetry Required for SEISS Data Processing

Spacecraft telemetry required to analyze SEISS data **shall** be provided to the SEISS ground system whenever SEISS data is available. The spacecraft data that is required to analyze the SEISS data includes the ephemeris and spacecraft attitude.

3.2 Power

3.2.1 Average Power

The SEISS **shall** draw no more than 92 W (TBR) averaged over five (5) minutes (TBR).

3.2.2 Peak Power

The SEISS total peak power input including heaters **shall** be no more than 100 W (TBR) over 30 seconds (TBR).

3.2.3 Survival Power

When the instrument is OFF, the instrument survival heaters **shall** consume no more than 35W (TBR) averaged over every 72 (TBR) minute period.

3.3 Mechanical

The requirements in this section apply to the structural and mechanical components of the instrument flight units.

3.3.1 Mass Properties

The SEISS, including all units, mounting hardware, thermal blankets and cabling **shall** have mass less than 42 kilograms (kg) (TBR).
The length of the cabling between SEISS units **shall** be less than 4.5m (TBR)

3.3.2 Volume

The instrument, including mounts, thermal blankets and connectors for both stowed and operational configurations **shall** have dimensions that do not exceed a total volume of 85,000 cu. Cm. (TBR).
The maximum dimension of any component **shall** be less than 40 cm (TBR).

3.3.3 Fields of View

The following Fields of View are referenced to the axes of the spacecraft Body Reference Frame defined in paragraph 3.1.4-2 of the GIRD.

3.3.3.1 Magnetospheric Particle Sensor FOV

3.3.3.1.1 Low Energy Electron and Proton Sensor

The spacecraft **shall** provide a continual unobstructed field of view of 170 degrees in the YZ plane, 30 Degrees (TBR) in the XZ plane, and symmetric about the XZ and YZ planes.

3.3.3.1.2 Medium and High Energy Electron and Proton Sensor

The spacecraft **shall** provide a continual unobstructed field of view of 170 degrees in the YZ plane, 30 Degrees (TBR) in the XZ plane, and symmetric about the XZ and YZ planes.

3.3.3.2 Solar and Galactic Proton Sensor

The spacecraft **shall** provide continual, unobstructed FOV to each of the SGPS sensor heads, one with a +X look direction, and the other with a -X look direction.

The spacecraft **shall** provide a field of view of 60 degrees in the XY plane, 60 degrees in the XZ plane, and symmetric about the XY and XZ planes, for each of the sensor heads.

3.3.3.3 Energetic Heavy Ion Sensor

The spacecraft **shall** provide a conical field of view with a half angle of 30 degrees (TBR) about the minus Z axis.

3.3.4 Mounting

The spacecraft **shall** provide mounting space for the SEISS on the three axis stabilized body of the spacecraft with the sensors located to provide the fields of view specified in paragraph 3.3.3.

3.3.5 Alignment

The spacecraft **shall** align the sensor axes in Section 3.3.3 to within +/-2 deg (TBR) of the respective spacecraft BRF axes.

4 Constraints

In order to ensure proper instrument performance or to prevent possible instrument damage, the following Government-approved constraints are imposed by the instrument developer on spacecraft integration and test activities, including launch, activation and operations. No constraints have been identified at this time.

5 GIRD Deviations

This section identifies General Instrument Requirements Document (GIRD) requirements that the government has deviated from for this instrument. Where appropriate, corresponding GIRD paragraph titles and numbers are identified in parentheses.

(3.2.1.5.1 References GIRD 129, 3.2.1.5.1.1-1) An alignment cube is not required.
(3.2.2.1 Thermal Control Concept GIRD 1132, 3.2.2.1-1 c) second bullet) The SEISS instrument sensor units **shall** be thermally coupled to the spacecraft for thermal control.

6 Acronyms and Abbreviations

APID	Application Process Identifiers
C&DH	Command and Data Handling
CCSDS	Consultative Committee for Space Data Systems
CCN	Contract Change Notice
cu. cm	Cubic Centimeters
dB	deci-Bell(s)
EHIS	Energetic Heavy Ion Sensor
FOV	Field of View
GIRD	General Interface Requirements Document
GOES	Geostationary Operational Environmental Satellite
GSFC	Goddard Space Flight Center
Hz	Hertz

ICD	Interface Control Document
IDD	Instrument Description Documents
kg	kilogram(s)
m	meter(s)
m-g	milli-g's (Earth's gravitational acceleration)
MHz	Megahertz
MPS	Magnetospheric Particle Sensor
NASA	National Aeronautics and Space Administration
PORD	Performance and Operations Requirements Document
sec	second(s)
SEISS	Space Environment In-Situ Suite
TBD	To Be Determined
TBR	To Be Reviewed
TBS	To Be Specified
UIID	Unique Instrument Interface Document
W	Watts